

Model Name and Version: NEMS (National Energy Modeling System) Versions of NEMS are distinguished by run name and date; each module of NEMS is updated for each year's *Annual Energy Outlook* and for special analyses.

Model Type: General equilibrium energy-economic model of U.S. energy markets with energy-related emissions. Emissions modeling includes energy system-wide carbon dioxide and methane emissions, with the capability to include carbon dioxide fees or caps, and emissions caps, trading, and banking of emission credits for carbon dioxide, sulfur dioxide, nitrogen oxides, and mercury in the electricity generation sector.

Developer/Home Institution: U.S. Department of Energy, Energy Information Administration, Office of Integrated Analysis and Forecasting, Washington, D.C. 20585

Sector Detail: NEMS represents energy supply, demand, and conversion sectors of domestic energy markets, plus international and macroeconomic modules. Modules represent:

Household Expenditures

Residential and Commercial Demand (approximately 14 and 10 end-use services, respectively)

Industrial Demand (approximately 15 industries)

Transportation Demand (approximately 12 cars and light trucks)

Electricity Markets (fossil, renewable, and nuclear technologies)

Renewable Fuels (wind, geothermal, solar thermal, solar photovoltaic, municipal solid waste, ethanol, wood and other biomass, conventional hydropower)

Oil Supply (onshore, offshore, enhanced)

Natural Gas Supply (onshore, offshore, coalbed methane, shale, sands, international, LNG)

Natural gas transmission and distribution (core, noncore, peak, offpeak, pipeline capacity expansion)

Petroleum Markets

Coal Markets (sulfur, thermal, and mining characteristics)

Regional Detail: US, with international imports and exports taken into account. Three to 20 geographic regions characterized, depending on sector. Electricity production, costs, and potential of renewable resources are represented for 13 NEMS regions (based on NERC regions or NERC region subsets).

Technology Detail: (Please note that the numbers given below are approximate.)

Residential 34 end-use technologies

Commercial 10 distributed generation technologies; 64 end-use technologies

Transportation 6 cars; 6 trucks; 59 LDV fuel-saving technologies; 6 advanced aircraft; medium and heavy freight; 10 advanced freight truck technologies

Electricity 11 fossil; 7 renewable; conventional and advanced nuclear (can accommodate more than 50 technology options overall)

Oil & Gas 33 refining technologies

Time Period: NEMS is used annually to produce the *Annual Energy Outlook* and other analyses with projections 20 to 25 years into the future, and model results calculated on an annual basis over that time period.

Special Features: Used to project energy, economic, and environmental effects of energy policy and market attributes. Useful to assess year-to-year changes resulting from new energy programs and policies.

Treatment of Renewable Energy: NEMS characterizes renewables, with principal technologies including commercial and residential geothermal heat pumps, solar hot water heating, and distributed solar photovoltaics (PV); industrial cogeneration using biomass and municipal solid waste; transportation ethanol; and for central station electricity supply - biomass, conventional hydroelectricity, geothermal, landfill gas, solar PV, solar thermal, and wind. Resources are characterized for each technology, by NEMS region and, for intermittents, by time of day and season. Intermittent penetration is limited within region and by reducing capacity contributions to reserve margin. All fossil, nuclear, and renewable technologies incur uniform interconnection charges within region; wind incurs small additional interconnection charges varying by distance to the existing lines. NEMS accommodates limited interregional electricity trade and trade with Canada.

Major Users/Applications: NEMS is used for the Annual Energy Outlook, as well as numerous other DOE and EIA studies. NEMS is used for energy policy analysis, including analyses of national renewable energy standards for electricity and transportation, production tax credits, and research and development programs.

Documentation:

Energy Information Administration (2000). *The National Energy Modeling System: An Overview*. Energy Information Administration: Washington D.C. DOE/EIA-0581(2000). Each NEMS module's documentation is updated annually after publication of the *Annual Energy Outlook*.

Renewable Fuels Module Documentation:

[http://tonto.eia.doe.gov/FTP/ROOT/modeldoc/m069\(2002\).pdf](http://tonto.eia.doe.gov/FTP/ROOT/modeldoc/m069(2002).pdf)

URL: www.eia.doe.gov